



NOAA
FISHERIES

Office of Aquaculture



Feed innovation is improving aquaculture sustainability and increasing industry efficiency.

Research and developments by federal agencies and feed manufacturers have reduced environmental impacts of feed and continue to conserve natural resources.

Learn more:
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Sustainable Aquaculture Feeds and Fish Nutrition



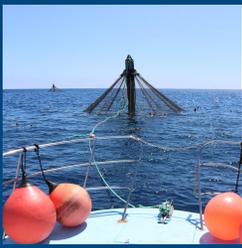
Feed innovation is improving aquaculture sustainability. Credit: Getty Images.

Aquaculture Feeds and Healthy Fish

Fish, both farmed and wild, require a balanced mix of essential nutrients, amino acids, fatty acids, and energy to thrive. Farmed fish are fed diets specially designed for their nutritional needs. Their feed contains all the essential nutrients needed to keep them healthy and growing, and is usually in the form of dried pellets, similar in many ways to dry pet food.

Traditionally, fish feeds have contained a high percentage of fishmeal and fish oil, to ensure the balance of nutrients that most closely resembles the requirements of fish. Fishmeal and fish oil can be made from almost any type of seafood, but are generally manufactured from the harvest of small, open-ocean (pelagic) fish such as anchovies, herring, menhaden, sardines, and mackerel. These fish have short life cycles and are capable of rapid reproduction and stock replenishment.

However, concerns over the ecological impact of removing small pelagic fish and the rising cost of fishmeal and fish oil have driven innovations in sustainable aquaculture feeds. Today, partial or total replacement of fishmeal and fish oil in feeds has become common practice in commercial feeds. These alternative feeds seek to decrease the industry's reliance on pelagic fish while maintaining fish and human health.



WHY FARM SEAFOOD?

Today, the United States imports between 70-85% of the seafood we eat by value—more than any other country. Global and domestic demand for seafood continues to grow. Even as we maintain and rebuild our wild harvest fisheries, we cannot meet increasing domestic demand for seafood through wild-caught fisheries alone.

Marine aquaculture provides a domestic source of economically and environmentally sustainable seafood that complements and supports our wild fisheries production.

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GROWING NUMBER OF SUSTAINABLE FEED INGREDIENTS

Traditionally, diets for carnivorous fish contained over 50% fishmeal and oil. These percentages have decreased as alternative feed sources continue to be developed.

Through research, scientists and fish farmers are learning that other combinations of ingredients can achieve a balance of the essential nutrients required by fish, thus allowing a decrease in fishmeal and fish oil use. Along with environmental benefits, these less expensive replacement feeds also present an economic benefit for farmers.

Sustainable replacement options being developed include meals and oils from plants (the greatest source of protein and edible oil on Earth), fish processing trimmings, yeast, insects and other special meals, even seaweed. Alternative ingredients already in use include proteins from soybeans, corn, peas, and wheat, and oils from soybean, canola, and flaxseed.

Through these replacements, reliance on raw marine materials for aquaculture feeds is steadily declining. A *Nature* article found that fish-based ingredient use for Atlantic salmon has declined from 90% in the 1990s to 25% in 2020.¹

TAURINE ADVANCEMENT BENEFITS FARMERS AND SUSTAINABILITY

The U.S. Food and Drug Administration (FDA) recently approved the use of the amino acid taurine for fish feed, further providing fish farmers with options to reduce our nation's reliance on feed made of other fish.

Taurine is a nutrient that carnivores need in their diets. It's essential for many bodily functions, including fat digestion and eyesight. Some animals, including people, naturally make taurine. But other carnivores, like cats and some fish, do not. So they have to get this nutrient from their diet. In the wild, carnivorous fish obtain taurine by eating other fish. These "forage fish" feed upon algae and are able to create taurine that accumulates in their body.

NOAA Fisheries research has shown that taurine is a key nutrient needed to make plant proteins nutritionally similar to other animal proteins. Thus the presence of taurine allows species like salmon to feed on more plant-based proteins instead of fishmeal. Other countries, including the European Union

and Canada, have been feeding taurine to farmed fish for years. Taurine was already approved for other animal feeds in the U.S., including food for dogs, cats, and chickens. It's also approved for people. However, the FDA requires an approval process for each kind of animal.

Recognizing the need for more sustainable feed options, researchers at NOAA's Northwest Fisheries Science Center along with other researchers demonstrated that taurine is an essential nutrient for some cold water marine fish. Based on numerous studies, including NOAA research, the FDA approved taurine for farmed fish. This approval in the United States puts U.S. farmers on a level playing field and opens up more options for feed—options that are safe, good for the environment, and provide a cost savings that may be passed on to consumers.

REFERENCES

1. Costello, et al. "The Future of Food From the Sea."